

western roads



western roads



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COVER

Water colour by Lieut. Du Cane of the bridge over the Swan River at Guildford, dated 1856. (Reproduced by permission of Dame Alexandra Hasluck).

This bridge was built in 1854 by Lieutenant, later Colonel Sir Edmund F. Du Cane while serving in the Royal Engineers in charge of the Guildford convict depot. The bridge was situated at the foot of Meadow Street and became known as Barker's Bridge, a name derived from the nearby Mr Samuel Barker's Store. Goods for the store - later the Barker and Gull Trading Company, were unloaded at a jetty alongside the bridge. The jetty has long since disappeared, but the brick building which housed the original store in Meadow Street can still be seen today.



Introduction

THE SWAN RIVER SETTLEMENT

When the first settlers arrived in June 1829 land was initially opened for selection along both banks of the Swan River as far upstream as Belhus, near the junction of Ellen Brook.

Settlements were also planned along both banks of the Canning River by Thomas Peel as part of an ambitious land settlement scheme (the first of many in the State), but a condition of allocation of land to Peel was that it be taken up by 1st November 1829. When, due to various delays and misfortunes, Peel and his settlers failed to arrive on time the land was allocated to settlers already in the colony and Peel had to be content with an allocation of land on the Murray River.

With early settlement concentrated around these river systems, it soon became obvious that bridges were needed for development, a need made greater by Governor Stirling's decision to site the administrative capital of Perth on the opposite bank of the river to the port of Fremantle. For the first fourteen years of settlement however, the colony relied principally on river transport between these two centres. There were also two land routes from Perth to Fremantle, one on the Southern bank and the other on the Northern bank, but both these relied on horse ferries to cross the river. The lack of a bridge in 1830 had tragic consequences for the family of Dr John Whatley. He and a friend, Captain Stryan tried to ferry a live cow across the river at Preston Point in a small boat and, when the boat not surprisingly capsized, both men were drowned.

HISTORY OF TIMBER BRIDGES IN WESTERN AUSTRALIA

Only one substantial bridge was built in the colony of Western Australia during the first fourteen years of the Settlement, a timber structure across the Helena River at Guildford constructed in 1835. This was located at Drummond's Crossing, approximately a quarter mile upstream of the present bridge. No details are recorded of this structure, but it is shown on a plan of Guildford which is dated 1842 as being connected with Drummond Street, which no longer exists. The bridge was replaced in 1867 with a new structure designed by Richard Roach Jewell, who later became Director of Public Works. The second bridge was located close by the present crossing and the remains of the old piles for Richard Jewell's structure can still be seen alongside the existing bridge.

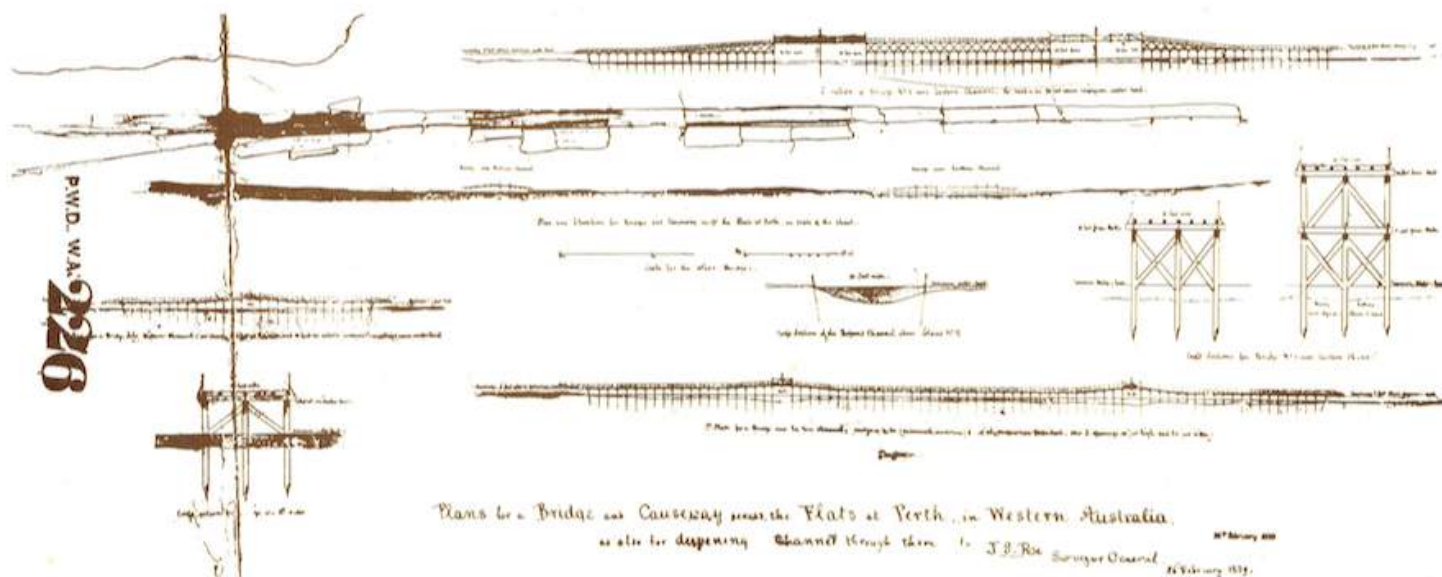
FIRST BRIDGE OVER THE SWAN RIVER

Two alternative sites were considered for a bridge over the Swan River in the early 1830's, one at the Narrows and the other at the Causeway. A bridge at the Narrows would have provided more direct access to Fremantle whereas one at the Causeway gave better access to the agricultural areas being opened up around Guildford and along the upper reaches of the Canning River. The needs of Guildford Settlers must have prevailed as the site chosen was the Causeway Flats at the eastern end of Perth, a wide shallow section of the river where a number of channels flowed between low islands. Construction at the Causeway site must also have appeared much



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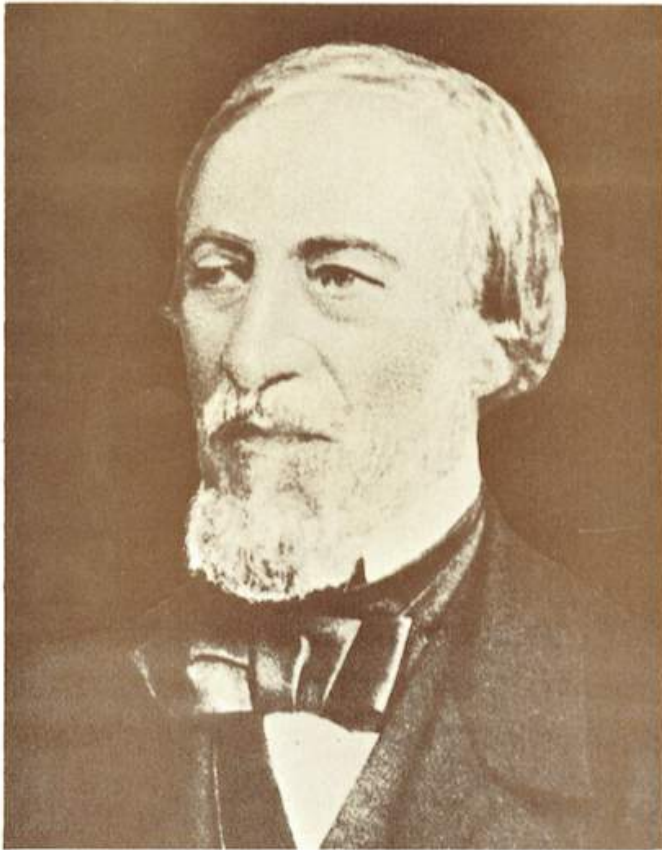
easier to the prospective builders, bearing in mind their very limited resources for construction at that time.



Plans for the first Causeway Bridge prepared by J.S. Roe, Surveyor General, in 1839. (Courtesy Library Board of W.A.)

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In 1834 a preliminary survey of the islands had been made by G.F. Moore, Commissioner for Roads and Bridges, and in 1838 construction was started on a road leading to the Causeway.



J.S. Roe; Surveyor General of the Colony from 1829 to 1870.

Designs for the bridge were prepared by the Surveyor General J.S. Roe. These were subsequently modified by the Superintendent of Works, Mr Trigg in association with Major Frederick C. Irwin. In February 1839 the General Roads Trust resolved to go ahead with the structure at an estimated cost of £1 800 and the first pile was driven in 1840. The bridge was completed 3 years later at a total cost of £1 814.10s.Od.

The bridge consisted of two timber structures spanning the main river channels and connected by a series of causeways over the islands and river shallows. The Government Gazette of May 19, 1843 contained the following notice:

"Notice is hereby given that the Causeway of the Flats will be opened to the public on Wednesday, 24th instant at 11 o'clock.

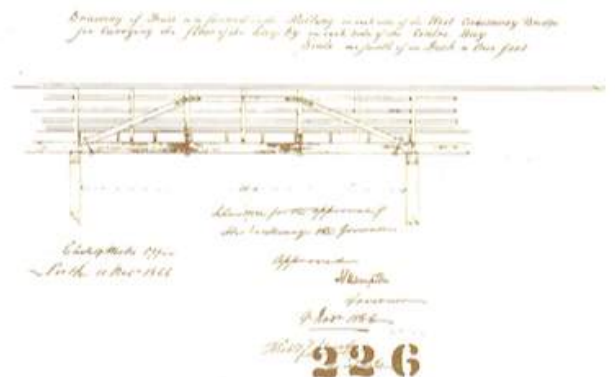
Tolls - For every foot passenger	- 1d.
For every sheep, lamb, pig, goat	- 1d.
For every head of neat cattle	- 3d.
For every horse, ass, mule	- 3d.
For every gig, chaise, cart, dray or other vehicle drawn by one horse or other animal	- 6d.
For every additional animal	- 6d."



The first Causeway Bridge - opened in May 1843

Tolls were charged at this time for the Canning River and Perth ferries and the idea was obviously extended to the first Causeway bridge. They were later abolished and do not appear to have been charged on any other bridge except the first Canning Bridge.

In July 1862, after heavy rains during the preceding month, there was a great flood in Perth which overtopped the Causeway Bridge by 7 to 8 feet and washed away part of the structure. Richard Jewell, the Clerk of Works, prepared plans for Governor Hampton for the repair of the bridge and supervised the reconstruction. The bridge was raised several feet and a third bridge was provided.



Details of truss for second Causeway Bridge prepared by Richard Jewell in 1866 and signed by Governor Hampton. (Courtesy Library Board of W.A.)

HISTORY OF TIMBER BRIDGES IN WESTERN AUSTRALIA

Richard Roach Jewell played an important part in the early development of the State and both he and his contemporary James Manning were responsible for many of the major bridges built during this period. Jewell arrived in W.A. in 1852 and was appointed Clerk of Works to the Colonial Works Department in 1853. He had trained as an architect in England, having been articled to an Architect and Builder in Barnstaple, North Devon. Before emigrating to W.A. at the age of 42 he had worked on a military prison at Gosport, Stanstead College, extensions to fortifications at Portsea and at Southsea Castle. Jewell was a member of the strict Plymouth Brethren and it is interesting to speculate whether the religious intolerance prevalent in England at that time was the reason for his decision to start a new life in W.A. at the age of 42. Richard Jewell built bridges over the Swan at Helena, and over the Dale and Avon Rivers, but his most important works were Government House and the Perth Town Hall.



The Causeway Bridge c. 1930 showing widening for trams.



The second Causeway Bridge; rebuilt after the floods of 1862 and opened in November 1867.

The work of repair and reconstruction on the Causeway was carried out by Solomon Cook, a blacksmith and wheelwright. Solomon Cook employed six apprentices during the reconstruction and one of them, John S. Maley, later forestalled Governor Hampton in opening the bridge. Just as Governor Hampton was about to declare the bridge open, on November 12th 1867, apprentice J.S. Maley galloped across it on a horse and the Governor is

reported to have then said "I declare this bridge opened by J.S. Maley".

The bridge was widened in 1903, when tram lines were added to the upstream side and a further 10 ft widening was added to the downstream side in 1933. The old bridge was finally replaced by the present steel and concrete structure in 1952, after a total life of 109 years - a considerable achievement for a timber bridge.

HISTORY OF TIMBER BRIDGES IN WESTERN AUSTRALIA

EARLY BRIDGES OVER THE CANNING RIVER

Once the Causeway Bridge had been completed the only major watercourse to be crossed on the route to Fremantle was the Canning River. The first mention of a bridge over the Canning River was made by Archdeacon Wollaston, a tireless traveller among the early settlements. He kept a diary of his travels and in January 1842, while enroute from Picton to Guildford in the company of Major Irwin and R.H. Bland of York, stopped to have breakfast at Kelmscott on the Canning. After breakfast he has an entry in his diary:

"Crossing the river at a clumsy bridge, Mr Bland struck off the nearest way to Perth, but the Major and I rode ten miles to Guildford".

The more important crossing of the Canning was however, on the road to Fremantle near its confluence with the Swan. Tenders for this structure were called in the Perth Gazette of December 26, 1846 but the prices were too high. Tenders were recalled in 1849 and a contract was awarded to Solomon Cook, who completed the bridge in 4 months for a cost of £400. The bridge was 520 feet long and 12 feet wide, with a deck 8 feet above high water, and was opened to the public in December 1849. A second Canning bridge was built by convict labour in 1867 and this structure was raised to give

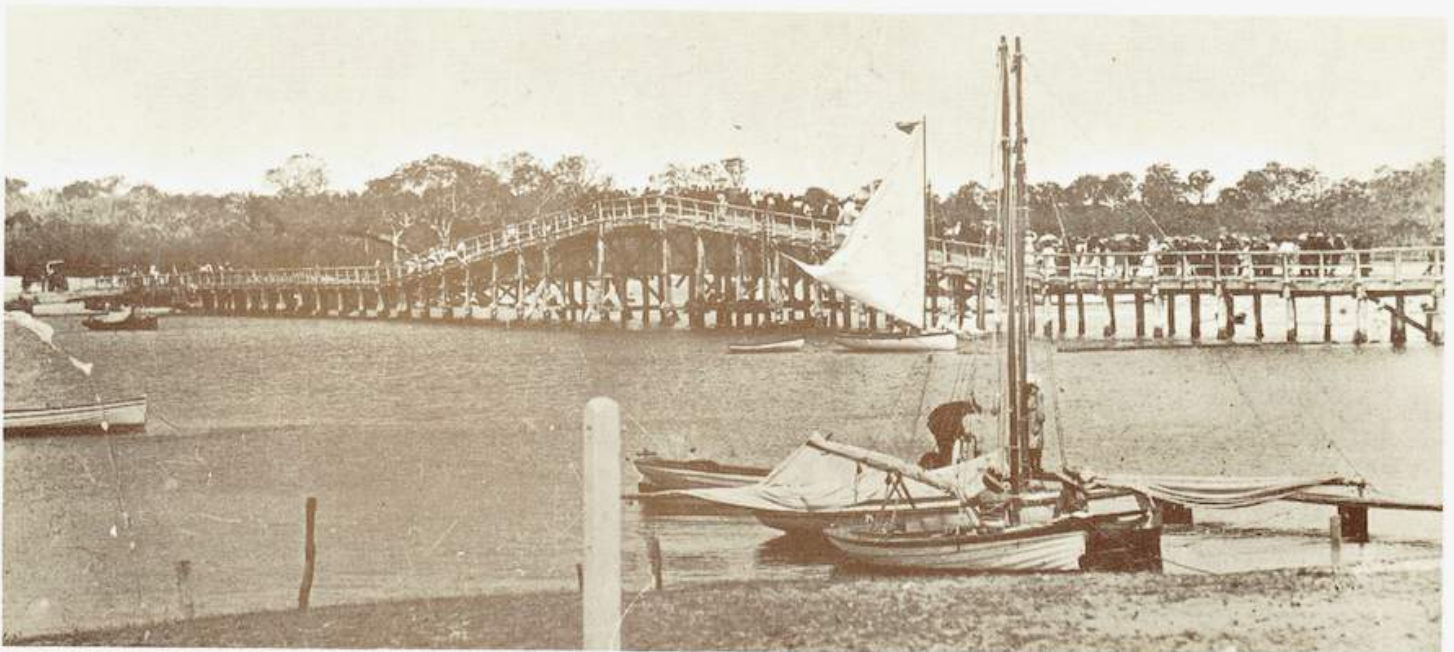
increased navigational clearance in 1892. The third Canning Bridge was built in 1908 and this was replaced in 1938 at a cost of £49 660 by the present bridge, which has a 35 foot steel navigation span. Such has been the growth of traffic on the Canning Highway that a duplicate bridge was built in 1958 and both the present bridges were subsequently widened in 1965.

EARLY BRIDGES IN OTHER DISTRICTS 1840 -1850

While the towns of Perth and Fremantle were growing, development was proceeding in other parts of the State.

Two years prior to the founding of the Swan Settlement Major Edmund Lockyer established a convict settlement at Albany, on King George Sound, but the military and prisoners were withdrawn in 1829 as a consequence of the British Government's decision to make Western Australia a free settlement. The result was that the tiny settlement stagnated for 4 years until Sir Richard Spencer arrived as Government Resident of King George Sound in September 1833.

In the South West of the State settlement commenced in 1830 at Augusta, under the leadership of the Government Resident Capt. John Molloy. The land at Augusta was very difficult to clear, however, and the settlement did not prosper. At the end of 1835 the Bussel family and some other settlers moved from Augusta to the Vasse River, and were eventually followed in 1839 by Capt. Molloy and his



Canning Bridge. Photograph is undated but probably shows the second bridge built in 1867, after it was raised in 1892.

HISTORY OF TIMBER BRIDGES IN WESTERN AUSTRALIA

family. In 1841 a land settlement scheme was established at Australind on the Leschenault Inlet by the Western Australian Company, under the leadership of Marshall Waller Clifton and, although this scheme also eventually failed, settlers did remain in the district. East of Perth land was taken up around the future town of York as early as 1830 and townships gradually developed at York, Northam and Toodyay.

By the early 1840s a number of isolated and scattered settlements had therefore become established and it was essential for the development of the Colony that these be linked by a basic network of roads. As these roads crossed rivers and streams which in winter became impassable, bridges were urgently needed. Some early bridges were built by the settlers themselves, but labour was scarce and wages high so that by the end of the first decade the growth of the colony was being retarded due to the lack of such facilities.

Up to 1838 the responsibility for roads and bridges was assigned to two Commissioners, the Surveyor General and the Advocate General. In that year a change was made and a General Roads Trust was created, which consisted of 40 Trustees who had entire responsibility for road and bridge construction. The colony was divided into four Districts with a Director appointed for each District. The Directors advised the Trust of the road and bridge needs of each District but the funds available to the Trust were very limited, (in 1841 expenditure was only £ 1 700) and as a result they became very unpopular. In 1842 the Trust was abolished and a Central Roads Board created with 8 District Roads Boards. The Districts reflected the extent of settlement at that time and were Swan, York, Pinjarra, Toodyay, Canning, Leschenault, Albany and Vasse.

The earliest bridge across the Swan River upstream of the Causeway was built by Mr Sam Moore to connect the two parts of his property known as Oakover, and was located some 3 km upstream of the present Middle Swan Bridge. The date when this bridge was erected is not recorded, but in 1928 the son of Sam Moore, Mr Fred H. Moore, recorded some reminiscences of his childhood at Oakover and recalled seeing the river rise over the handrails of the bridge in the great flood of 1847. It was during this flood that the eastern half of the bridge was swept away. Fred Moore recalled that the bridge was never rebuilt due to the death of his father two years later in 1849. Since this bridge was a well-known landmark by 1847 it could well be that it was constructed before the Causeway Bridge in 1843, and

therefore entitled to the distinction of being the first bridge over the Swan River. The bridge must have been a substantial structure as it was built to take carts and, although privately owned, was used by the general public. There was a painted notice fixed to a gum tree alongside the bridge which said:

"This bridge is private property. Open from sunrise to sunset; strangers and visitors free. Settlers using it for their own convenience must contribute to the upkeep thereof".

A number of bridges were built in the 1840s in the Leschenault district and information on these has been supplied by Miss E.K. Clifton of "Alverstoke", a great grand-daughter of Marshall Waller Clifton.

'The following notes were made by my father A.F. Clifton from the diaries of his grandfather Marshall Waller Clifton'. "M.W. Clifton settled at Australind in March 1841. He also farmed "Alverstoke" five miles away which meant the Brunswick River had to be crossed and a ferry boat was established in 1843. The first lower



*Lower Brunswick Bridge built 1845 - Photograph taken 1897.
(Courtesy E.K. Clifton)*

Brunswick Bridge was completed on 2nd March 1845 and did duty until 25th February 1932. Pearce Clifton organised the job and several of the young Cliftons assisted, but I believe William Forrest, father of Lord Forrest, was the builder. The present

HISTORY OF TIMBER BRIDGES IN WESTERN AUSTRALIA



First Lower Brunswick Bridge with replacement bridge on the left:- Photograph taken in 1932 (Courtesy E.K. Clifton)

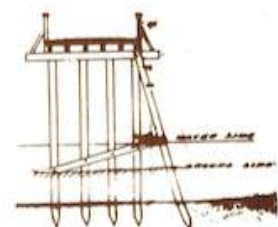
bridge was built by a Government Contractor and was completed on 25th February 1932.* The Preston Bridge near Leschenault was completed on 8th April 1846 and the Lower Collie Bridge on 28th November 1848. Both these bridges were built under contract by W. Pearce Clifton and paid for partly by the Government and partly by Settlers. The Long Collie Bridge near Roelands was commenced in 1865 or 1866 and completed in 1868 or 1867. W. Marriott was the first man to take a team over it. The Brunswick Bridge near Brunswick Post Office was built by a Mr Batt, a settler from Serpentine, in the summer of 1861. Harvey Bridge was also built by Mr Batt in the summer of 1861. The bridge over the Preston River near Picton and known as the Fordling Bridge was built near the spot where the old ford was. Mr William Forrest was the contractor. I have been unable to find a date in connection with this bridge but think it was about the same time as the Long Collie Bridge in the sixties".

***Author's note:** This bridge has subsequently been replaced by a third bridge.

Very few details have come down to us of these early bridges, but two photographs of the first Lower Brunswick Bridge, one taken in 1897 and the other in 1932, immediately after construction of the second bridge, illustrate the form of construction. The deck is about 3 metres wide, sufficient for a horse drawn cart, and consists of transverse sawn planks supported on sawn timber beams spanning about 7.5 metres between timber piles. These beams were braced by sloping timber struts springing from the piles just above water level and meeting the beams at points of $1/3$ span.

Another important early bridge was that over the Murray River at Pinjarra. In 1840 the Road Trust made available £ 50 for bridges over the Dandalup River and the Murray River at Pinjarra. The bridges were completed in 1841 but the Murray flooded that year and the decking lifted off the Murray Bridge and slewed round onto the left bank. Here it stayed, despite the efforts of the resident magistrate F.C. Singleton to obtain funds for its reconstruction, until it gradually broke up and drifted downstream. Funds were found the following year, however, and in 1842 the lowest of 3 tenders was accepted from John McLarty for rebuilding the bridge for £ 130. The rebuilt bridge had masonry piers and four timber spans some 15 feet high. It was a substantial struc-

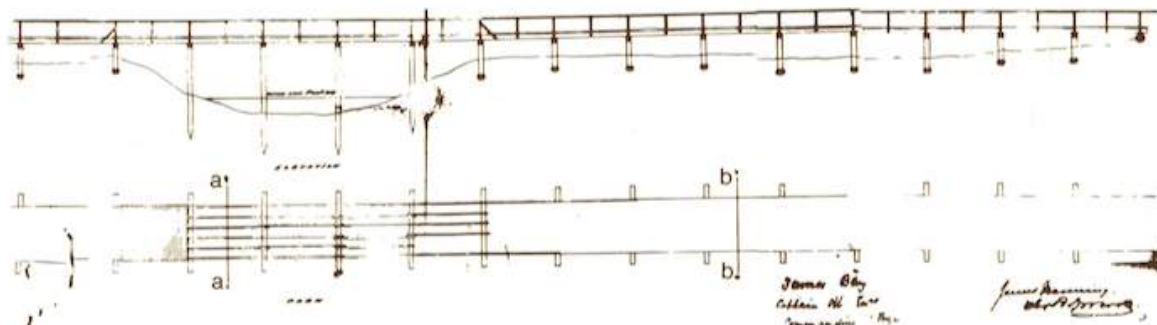
Dandelup River Bridge



SECTION aa



SECTION bb



Plans of proposed bridge over Dandelup River at Pinjarra - Prepared in 1859 by James Manning & Capt. Bury R.E. (Courtesy R. Richards).

ture but constructed far too low for a river as large as the Murray. In 1847 the Murray River flooded again and swept the bridge away. It was rebuilt by convicts in 1855. The new structure also had masonry piers but was a much larger structure, being 36 feet high, 285 feet long and 15 feet wide.

THE CONVICT ERA 1850 - 1864

Throughout the 1840s the colony suffered from the general economic recession in Australia. Prices for produce were low but, due to the shortage of labour, wages were high and there was a great shortage of money in the colony. By 1849 the situation was becoming desperate and a number of settlers petitioned the British Secretary of State, Earl Grey, for the colony to become a penal settlement. As the convict system was by then being opposed by the Eastern Colonies, the British Government readily agreed and the first shipload of convicts arrived on June 1, 1850 in the ship 'Scindian', under the charge of Capt. E.Y.W. Henderson. The arrival of the convicts marked the beginning of the first real progress in construction of Public Works, including bridges, in the colony and the attendant expenditure of imperial funds provided a much needed stimulus to the economy.

When Capt. Henderson arrived in the colony he was forced to lease various premises to accommodate his 70 convicts and realised that it was essential to build a proper prison as soon as possible. He therefore sent a request to England for some Royal Engineers to prepare plans and supervise the convicts on construction work. On 23rd December 1851, the 20th Company of Sappers and Miners arrived with First Lieut. Wray and Second Lieut. Du Cane on the ship 'Anna Robertson'. Lieut. Crossman had arrived a little earlier in the 'Marmion'.

Lieut. Wray, the most senior officer, was stationed at Fremantle, Lieut. Crossman had a roving commission between Perth and King George Sound, where he was stationed most of the time, and Lieut. Du Cane was stationed at Guildford to be responsible for

what was then known as the Eastern District. Over the next 4 years these three officers were responsible for construction work carried out in the colony and to Lieut. Du Cane fell the work of building most of the bridges constructed during that period.

The first bridge on which convict labour was used was that at Upper Swan. The bridge was commenced in 1850 under the direction of Surveyor Hillman with a work party of convicts. It consisted of three bridges connected by causeways. From the south end a causeway 60 feet long led on to the main bridge, then another 60 feet long causeway connected with a smaller bridge 45 feet long. A 340 feet causeway joined on to a third bridge 24 feet long, followed by a cutting through the steep bank on the north side. The causeways were constructed of logs surfaced with a layer of earth. The bridge was in use by January 1851 and local settlers were obliged to assist in construction by providing horses and carts for the work.

On July 26, 1871 tenders were called:

"for moving the whole of the old Swan Bridge, except the piles in the water".

The original Upper Swan Bridge was destroyed by the floods of 1862 and a new bridge was erected alongside almost immediately. The timbers from the old bridge were not finally removed until 1871. The second bridge at Upper Swan stood for 64 years, when it was destroyed by floods in 1926 and replaced by a third timber bridge. The present structure is the fourth bridge on the site and was built in 1955 and widened in 1977.

Bridges built by the Royal Engineers and their convict workmen are far better documented than earlier structures. Each district engineer had to submit a half-yearly report to the Comptroller-General, Capt. Henderson, and these were incorporated in despatches from the Governor to the Colonial Secretary. These have been preserved in a number of volumes under the title of "Convict System". Thus, in the report of the Comptroller-General dated November 15, 1852, we read that a bridge over

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Meredith Creek, close to the entrance to Bunbury was in course of construction and a bridge was planned over the Capel River about 11 miles from Bunbury on the road to Vasse.

The report continues -

"a causeway nearly half a mile long over a swamp on the south bank has been made by a party detached from Bunbury for the purpose. The timber for the bridges is nearly ready, and will be proceeded with as soon as men can be spared for the purpose. As this river entirely cuts off the communication between the southern districts, rendering a detour of many miles through deep sand necessary, this bridge is of great importance to the settlers. The timber for the bridge has been paid for by the local government."

The mention of the long detour is no doubt a reference to the practice of early settlers of crossing the rivers in that area over the shallow sandbars where the rivers flowed into Geographe Bay. The same report also mentions that preparations were being made for erecting a bridge over the Kalgan River, -

"to enable stockholders to bring their cattle to the settlement" (of Albany).

In the half yearly report by the Comptroller General dated May 1853, it is noted that the bridge over Meredith Creek was completed, and that the bridge over Capel River had been commenced and would shortly be ready for use. Construction of the Kalgan Bridge had however been abandoned in consequence of men being hired into private service.

In December 1853 the Comptroller-General submitted a report for the half year ended June 30, 1853 and this included as an appendix a report by Lieut. Du Cane dated July 26, 1853, in which he describes the start of construction of a bridge over the Swan River at Guildford:

"A double frame bridge of six bays, each thirty feet wide, across the Swan, has been completed as far as three bays, with the exception of the planking and rails. A part of the timber necessary for the remainder has not yet been delivered, so that the completion is delayed".

Further progress was described by Lieut. Du Cane in his next report to the Comptroller-General dated January 26, 1854 as follows:

"Timber required for Guildford Bridge has been provided and the 6 bays which span the water completed; the timber for the pier(s) of the approaches has also been cut and the stringers for part of them. Eight piers of the approaches have been put up and some of the stringers, being all that are required on this side of the river. Nothing has been done to the embankments since last report, but a ditch has been cut along the whole length, which will carry off such water as prevented us from working last rainy season. The Helena Bridge has been replanked".

Lieut. Du Cane's report continues with details of roadworks and then:

"The party who were working from York depot towards Toodyay, having completed the bridging as far as Northam, were transferred to the Toodyay depot to bridge streams towards the same place, they have finished three good substantial bridges".

The depots referred to were the convict depots from which the men were either hired out to settlers or employed in work gangs. There were 8 depots at this time located at North Fremantle, Mount Eliza, Guildford, Toodyay, York, Bunbury, Albany and Port Gregory.

The next report from Lieut. Du Cane was not submitted until September 25, 1854, no doubt delayed by the pressure of work. After describing the latest progress on the Guildford Bridge, including planting the approach embankments with couch grass and roses to prevent erosion, his report continues:

"Toodyay Road - A substantial bridge has been erected over Jane Brooke."

"Bindoon Road - A small party went out to make bridges on the road toward the end of May; they had 3 bridges in hand by the end of June."

"Northern Road - A small party, varying in number from 7 to 20, has been working on this road; they have finished all the bridges required between the depot and the place where the road crosses the river (about 15 miles), and have made all the necessary cuttings and drains to render the road thoroughly passable for that distance. They have also some timber for the bridge to be erected across the Avon near Northam."

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In his report of September 25, 1854 Lieut. Du Cane included the following description of the Guildford Bridge which is of considerable interest and suggests that he considered this as his major work in the colony. This is borne out by various letters written home at that time, extracts from which are included in the recently published biography of Du Cane by Dame Alexandra Hasluck.

"A bridge has been erected over the Swan River at Guildford, which requires only the planking to enable it to be made use of; it is built of Mahogany.* The river is 180 feet broad in summer and about 14 feet deep in the centre; but in heavy winter floods it sometimes rises 12 feet and covers the flats which are thereabout a $\frac{1}{4}$ mile wide and at such times the stream is very rapid. The portion of this bridge crossing the summer bed of the river has been made somewhat higher than the highest flood. It is in 6 bays, each 30 feet wide; the piers are formed by piles driven into the bed of the river, on which is a framework of heavy timber to carry the superstructure.

The remainder of the bridge is in bays 15 feet wide, formed of unhewn timber; the total length of the timber work is 480 feet; the width of 300 feet of the bridge is 18 feet and of the remainder 12 feet; there are earthwork approaches on either side of the river 450 feet in length and about 9 feet high where they touch the bridge, sloping gradually down to the ground, and there is about the same length of earthwork in a separate part of the flat which is 2 or 3 feet high."

*Author's note: Early builders referred to Jarrah as Mahogany.

The last report from Lieut. Du Cane is dated January 17, 1855 and records that for the Guildford Bridge:

"Four bays of 15 feet each have been added to the bridge on the right bank of the river; and the earthwork on that side, 630 feet long and 9 feet high, has been completed - the bridge is in use."

The same report goes on to mention that four bridges had just been completed on the Bindoon Road and that on the Upper Swan Road the approaches to the bridge over Susannah Brook had been put in order.

In July 1855 Lieut. Du Cane married Mary Molloy, daughter of John Molloy of Fairlawn, Vasse, and in February 1856 the Du Cane family sailed for England in the 'Esmeralda' where Lieut. Du Cane achieved considerable eminence as a prison reformer and was subsequently knighted for his work.

Du Cane's structure, built for a cost of £716, lasted until 1901, when it was replaced by a bridge built by the Public Works Department. The present bridge was built in 1949 by the Main Roads Department. When the present timber structure comes to the end of its useful life and is replaced by a more modern structure it would be fitting for the new bridge to be called Du Cane's Bridge, to commemorate the name of the young Lieutenant in the Royal Engineers who built the original structure at this site.

After about 1859 the convict system was gradually allowed to run down. No convict ship arrived in the colony in 1860 and the number of convicts reduced from 1 009 to 487. In April 1862 the Company of Royal Engineers returned to England and new arrangements had to be made for direction of convict labour.

The contribution made by convicts to the development of Western Australia deserves far better recognition. In January 1863 James Manning, Clerk of Works and E.M. Grain, Capt R.E. submitted a report on the total works performed by convict labour in the twelve years from the arrival of the 'Scindia' in June 1850 up to November 1862. The extent of road and bridge work alone is outstanding and included:

239 bridges erected or extensively repaired
543 culverts made and repaired
563 miles of road cleared, made and repaired.

Considering that during the first 21 years of the colony less than 10 bridges of any size were built, the achievements of the convicts in the following twelve years was quite remarkable and of inestimable benefit to the State.

In 1867 transportation of convicts to the colony was discontinued and the number of convicts steadily declined as men worked out their sentences. The system was finally disbanded in 1886, but not before the convicts had built the 3rd and last bridge made necessary by Governor Stirling's decision to locate the city of Perth on the opposite bank of the Swan River to the port of Fremantle - the bridge over the Swan at Fremantle.

HISTORY OF TIMBER BRIDGES IN WESTERN AUSTRALIA



North Fremantle Bridge. Commenced in 1863 and first opened to traffic in November 1866.

NORTH FREMANTLE BRIDGE

This bridge was commenced in May 1863 and took 3 years to build. A report prepared in 1865 states that the estimated final cost of the structure was £ 2 752 and at the end of 1867 the expenditure up to that date was £ 2 986 with the bridge still unfinished. After this date expenditure on roads and bridges in Perth and Fremantle are listed under one heading and the final cost of the bridge was never revealed. It was probably between £ 3 000 and £ 4 000.

The bridge was built with convict labour. During the first two years of construction the average number of men employed on the bridge was 48 and of these 28 worked in chain gangs, mainly blasting and quarrying stone for the bridge approaches.

The two men responsible for the design and construction of the bridge were Captain Grain, R.E., who was attached to the Fremantle Depot of the Comptroller-General's organisation, and had replaced Captain Wray R.E.; and James Manning, a Clerk of Works attached to the Imperial Establishment who had accompanied Captain Henderson R.E. out to Western Australia in the 'Scindian' in 1850. It seems probable that James Manning carried the major technical responsibility for the bridge. He had trained in England as a civil engineer and after working on the construction of various private mansions in London, joined the Ordinance Department at Tilbury Fort. An article in "The Possum" of 21st January 1888 states that he was responsible for all prison buildings in Fremantle, also Government House in Perth and, in association with Richard Jewell, the Town Hall and Pensioners Barracks in Perth. He was also responsible for construction and maintenance of all sea jetties at Albany, Vasse, Bunbury, Fremantle and Champion Bay. During his career in Western Australia he built bridges over the

Upper Canning River, the King and Kalgan Rivers at Albany and over the Avon River at York, Northam and Toodyay. The Fremantle Bridge over the Swan would certainly have been his largest and most difficult bridge construction job. He retired in 1872.

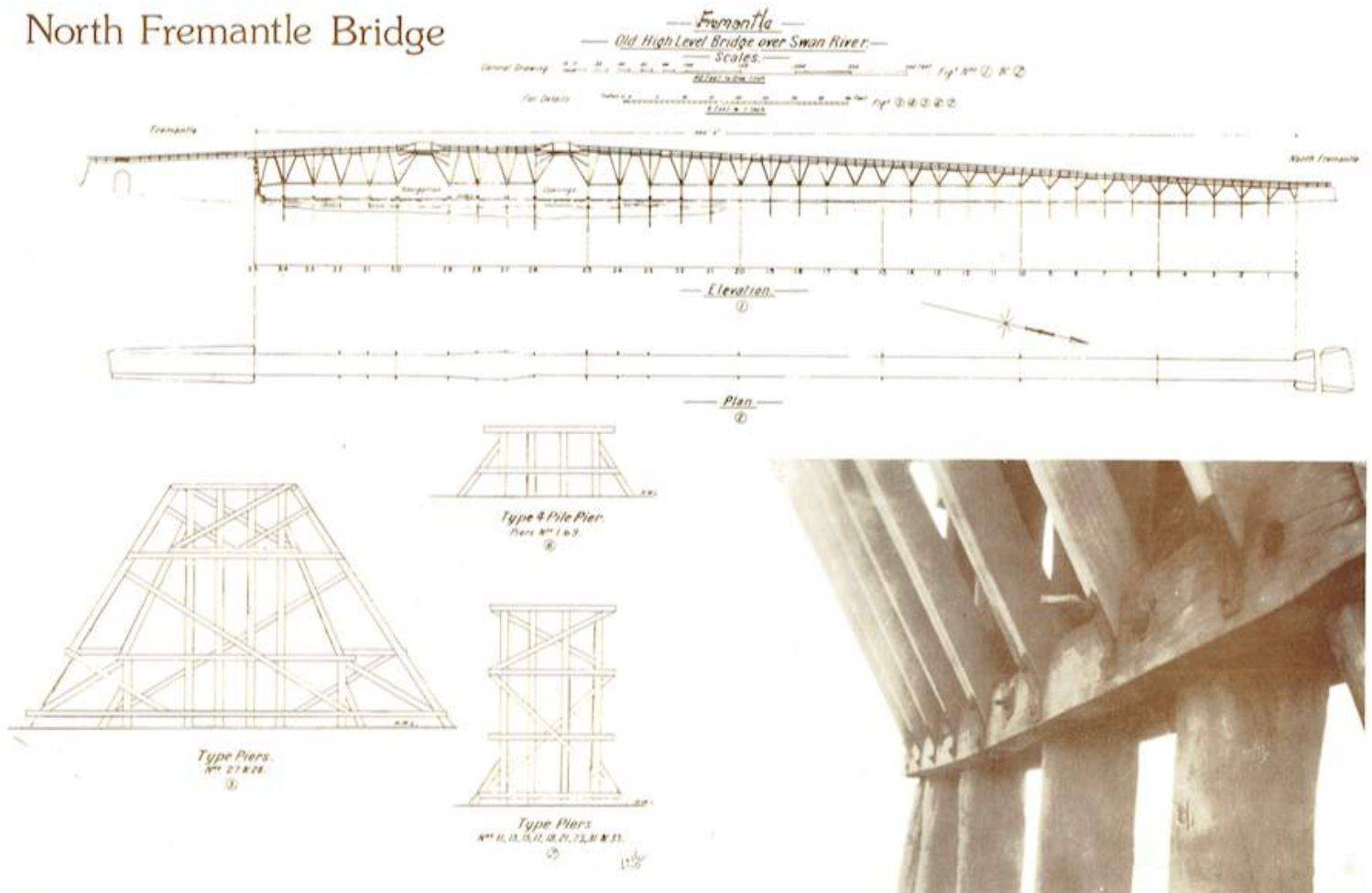
The bridge had a total length of 940 feet and consisted to two navigation spans each of 45 feet and 33 spans varying between 25 feet and 26 feet span. The width of roadway on the bridge was 18 feet and at the navigation spans the bridge was 44 feet above high water level. The bridge was founded on 319 timber piles and, except for the navigation spans, these were braced longitudinally approximately 14 feet above high water level. The junction between this bracing and the piles was then used as a springing point for sloping props which supported the deck superstructure at the third points of each span. At the navigation spans the superstructure was stiffened with two Queen Post trusses projecting above the deck on each side of the bridge. This was a standard type of construction used in the colony at that time and had been employed on both the Causeway bridge and Du Cane's bridge at Guildford.

Construction in the early stages was slow, no doubt due to the difficulty of driving piles in the swift tidal currents. The "Inquirer" of December 28, 1864 reported that 6 piles had been driven - not much progress for 2 years. Work must have speeded up, however, as there was a further report in the "Inquirer" during March 1866 that all the piles had been driven for half the distance across from the south side of the river, and that the upper section was fixed and the flooring laid.

The Perth Gazette reported that the bridge was thrown open at noon on Wednesday November 21, 1866, but it was nearly a year later before the "Inquirer" of October 2, 1867 reported that work on the bridge was complete, and a credit to the Clerk of Works, Mr James Manning, who supervised its construction.

HISTORY OF TIMBER BRIDGES IN WESTERN AUSTRALIA

North Fremantle Bridge



Plans of original North Fremantle bridge prepared from P.W.D. Plan 13708, c.1900.

Despite the size and importance of the bridge no formal opening ceremony was ever held, but the 'Inquirer' of November 28, 1866 carried an amusing report of an unofficial opening as follows:

"On Thursday evening last (that is, the night after the bridge was thrown open to traffic) our Volunteer Corps assembled on its parade ground at 8 pm for a moonlight march. The strains of the Band, as they marched through the town, soon attracted a numerous concourse of our inhabitants, who accompanied them on their march to the North Fremantle Bridge, and having crossed it, they, on their return, halted in the centre when Captain Manning gave a short address, the purpose of which I believe was that the bridge was a great boon to the colony, and that its want had been felt for many years; at the same time he expressed regret that it being the most

North Fremantle Bridge. Close-up of timber construction at springing for raking deck supports on high level bridge.

important work yet to be accomplished by convict labour, and one in which so much interest had been taken by the inhabitants of Perth and Fremantle, no public rejoicings has announced its being opened. The Corps then gave three cheers for His Excellency, and marched off in a cloud of dust, raised by the juveniles who preceded them."

In the early 1890s the bridge was reported to be unsafe and in 1892 the maximum load allowed on the bridge was reduced to 1¼ tons. On October 30, 1896 a notice appeared in the Government Gazette as follows:

"On and after the 27th October 1896 and until further notice, no person or persons shall be permitted to drive or lead any mob of cattle, camels or horses exceeding four in number over along or across this bridge or any part thereof..."

HISTORY OF TIMBER BRIDGES IN WESTERN AUSTRALIA

A Parliamentary Report on the bridge issued in 1896 contained what was probably the first traffic count ever carried out in the State. The count was taken on 17th May 1893 between the hours of 10 am and 4.30 pm and revealed the statistics shown in the table.

	Vehicles including Horses		Saddle Horses	Foot Travellers
For 6 hours		71	21	183
For rest of day	Add 50%	36	Add 50% 10	Add 160% 293
For 24 hours		107	31	476
say		140 tons	21 tons	24 tons

Total of 185 tons per diem say
60 000 tons per annum. At this
time the population of Fremantle
District was 7 077.

In 1898 a wider bridge was built alongside and on the downstream side of the old bridge, but at a much lower level, and became known as the Fremantle Low Level Bridge. On the opening of the low level bridge on 28th September 1898 the old bridge was closed to all except pedestrian traffic. It was intended that the low level bridge would only be a temporary structure while the old bridge was removed and replaced with a wider structure having two 75 ft navigation openings. Nothing further was done, however until 1908, when the Fremantle and the North Fremantle Municipal Councils wished to extend the Fremantle tramway system to North Fremantle. The temporary low level bridge was at the wrong level and had an awkward approach so a careful inspection was made of the old high bridge, including an underwater inspection of all piles. It was found that out of 319 piles examined 306 were absolutely sound and only 13 had some defect. No piles had to be renewed. By contrast, it was later found when the low level bridge was demolished that the piles in this structure were not in such a good state of preservation, although they had been immersed for some 30 years less. The difference in durability was ascribed to the more careful selection of timber by the early builders.

In view of the excellent state of the old bridge it was decided to renovate the superstructure and remove the low level bridge. The superstructure of the old high level bridge was cut down to remove the hump and at the same time the bridge was widened to allow for road traffic as well as trams. The low level bridge was closed on June 18, 1909 and later demolished.

Apart from being redecked in 1915 the old high level bridge continued in service until December 1939 when the present bridge was opened, a total life of 73 years.



North Fremantle Bridge c. 1930 The superstructure was cut down to remove the hump and the bridge widened to allow for trams in 1909.

The new bridge was also built in timber, but has three central navigation spans supported on steel girders, two of 17 m and one of 9 m. At the time this bridge was built it was expected to last only 3 to 5 years because of future extensions to the Fremantle Harbour, and as the timber structure only cost £ 75 000 it was preferred to a more durable structure in steel or concrete. Such is the durability of West Australian Jarrah, however that the bridge is still in use today, 40 years later, and has recently been renovated by the addition of a concrete overlay on the deck to extend its life still further.

The new bridge was opened on the 15th December 1939 by the then Premier, the Hon J.C. Willcock. In his address the Premier mentioned that the opening coincided with the completion of the Stirling Highway after 6 years of construction, and a change in public transport from trams to buses on this particular route. The Premier also remarked that the Commissioner of Main Roads, Mr E. Tindale, had assured him that the bridge could do service for the next 40 years if so required.

HISTORY OF TIMBER BRIDGES IN WESTERN AUSTRALIA

SOME NOTABLE FLOODS

Many of the early bridges suffered damage or were completely destroyed by floods and, in the early years of the colony, with no rainfall or flood records for guidance, determining the height and length of bridges would have been very much a matter of guesswork. The early bridge builders, with only their experience of English or European rivers to guide them, must have found it very difficult to comprehend that the stream which was only a small trickle in a dry creek bed during the summer could turn to a raging torrent 20 feet or more deep when in flood.

The first recorded flood in the colony was in Perth in May 1830, when the Swan River rose 20 feet above normal level and overflowed its banks. The diaries of both Joseph Hardy and Anne Whatley make reference to this flood, as both families had grants of land bordering the Swan and were forced to abandon their homes and build on higher ground. The settlers who experienced this flood used it as a yardstick for the severity of later floods for the next 20 years. The Swan River overflowed again in July 1831 but no other significant floods are reported until 1847. In that year heavy rains fell during July and August and the Swan River rose so high that some streets in Perth were flooded and the jetty was submerged. Extensive flooding was also reported around Northam, York and Toodyay, and bridges were washed away on the York and Toodyay roads.

In July 1862 occurred what the Perth Gazette at the time described as the "Great Flood in Perth". The peak flood level was estimated to be some 2 feet above the flood of 1830 but, because considerable development had taken place since that time, it created a great deal more havoc. The Causeway Bridge had between 7 and 8 feet of water over the deck and was damaged to such an extent that it had to be rebuilt. Another important bridge destroyed was that at Upper Swan. Part of the Canning Bridge was also washed away and the Helena River Bridge had water over its top rail. Losses were very extensive in the surrounding districts. At Northam the bridge over the Avon was swept away, and at Newcastle the bridge over the Avon disappeared, as did part of the bridge over the Canning River. (This would have presumably been the bridge at Kelm-scott.) Around Bunbury the country was completely inundated with water. Rainfall records kept by Mr G. Clifton at Fremantle showed that nearly 16 inches fell from the 1st June to the 9th July with nearly 14 inches of this total falling within 3 weeks. An interesting feature of the 1862 flood was the fact that unusually low tides were experienced over the whole

period so that the floodwaters could easily escape to the sea. The high flood levels were therefore entirely caused by the volume of flood water.

The 1862 floods caused great hardship throughout the agricultural districts and led to demands for more bridges. In the summer of 1863-64 a bridge was built over Gingin Brook near the junction with the Moore River, (known for many years as the Junction Bridge) and a few years later a further bridge was built over the Moore River some five miles upstream of the present Cowalla Bridge, and subsequently known as the "Old Bridge".

In January 1872 there was a great flood down the Irwin River which caused extensive damage to property around Greenough and Dongara. The flood was preceded by 6 days of excessive heat and was probably the result of a cyclone, although the newspaper reports of the time make no mention of high winds.

In the winter of 1872 serious and widespread flooding again occurred and there was considerable damage to bridges. At Guildford the Helena River rose 2 feet 3 inches above the level of the 1862 flood and the Helena River Bridge was damaged. A report in the Perth Gazette of the 26th July stated that at Northam the flood was about 18 inches higher than that of 1862. Water was half way up the hand-rails of the Avon Bridge but "the bridge stood well". The recently completed bridge over the Moore River did not fare so well and was washed away. It was rebuilt the following year.

There was serious flooding around Bunbury in 1878, when several bridges were severely damaged, but 26 years passed before there was again serious flooding in the South West. In July 1904 there was heavy flooding around Wagin, Narrogin, York and Pingelly and a bridge over the Dale River, 12 miles west of Beverley, was carried away. The following month there was severe flooding in the Helena and Swan Rivers and traffic was stopped over the Helena River Bridge and Barker's bridge. The following year, 1905, was also very wet with heavy rain extending from May to October. By this time the railway era had arrived in Western Australia and newspaper reports were mainly concerned with damage to railway tracks and railway bridges, rather than with damage to roads and traffic bridges.

THE ROLE OF THE PUBLIC WORKS DEPARTMENT

From 1886 when the convict system was disbanded, until 1926, when the Main Roads Department was formed, construction of bridges on public

HISTORY OF TIMBER BRIDGES IN WESTERN AUSTRALIA

roads was the responsibility of the Public Works Department.

A Public Works Department was established in 1829 under H.W. Reveley who was the first Engineer for the colony from 1829 to 1838. Reveley left the colony in 1838 and Henry Trigg was appointed Superintendent of Works. In June 1853 Richard Roach Jewell was appointed Clerk of Public Works and in 1875, after the Office of Surveyor General was created and the Public Works Department came under his jurisdiction, Richard Jewell was appointed Director of Public Works and held this position until he retired in 1884. In 1891 C.Y. O'Connor was appointed Engineer-In-Chief at a salary of £ 1 200. This was a princely sum in those days as at that time a junior draftsman was only paid £ 50 and a qualified draftsman received £ 180 per year.

During the convict era bridges were mostly built by convict labour but with some skilled tradesmen working under contract. Towards the close of the century, with the abandonment of the convict system, bridges were mostly built by contract. Unfortunately many of the records of this period were destroyed when the basement of the Government Building in Cathedral Avenue was flooded in 1890.

Many important bridges were built during this period, too numerous to list in a short account such as this, but one well known structure does deserve mention and that it is the Mandurah Bridge. In the early days there was a track from Fremantle to Mandurah and travellers had to cross the Murray River at the mouth of Peel Inlet by a ferry boat. The ferry service was very unreliable but despite considerable local agitation a bridge was not built until 1894. In that year a contract was awarded to Mr M. Price to build the bridge for £ 1 792. The bridge was a single lane structure, 600 feet long and, apart from having a passing bay constructed at the centre of the bridge in later years, it continued in service unchanged until 1953, when it was replaced by the present bridge.

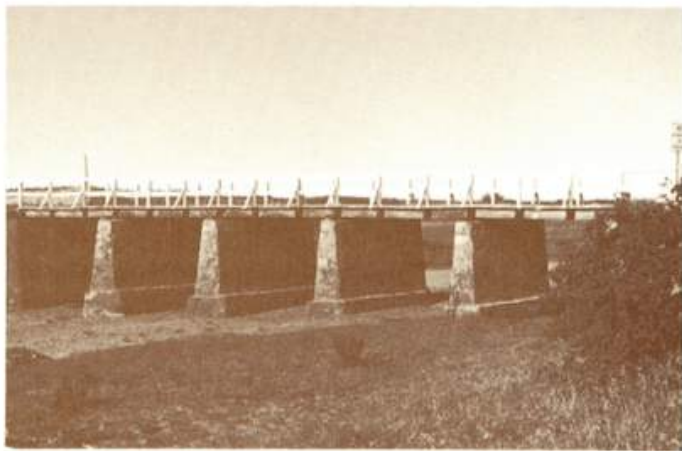
Timber bridges designed by the Public Works Department were gradually standardised over the years and were less elaborate than some of the earlier structures. They were mostly founded on timber piles driven into the river bed but some were constructed on masonry piers. The superstructures consisted of 12 inch by 6 inch sawn timber beams spaced 3 feet apart and spanning 20 feet. The deck was formed by transverse deck planks spiked or nailed to the timber beams. These bridges were capable of supporting a 6 2/3 ton axle load.

MAIN ROADS DEPARTMENT TIMBER BRIDGES

When the Main Roads Department took over from the Public Works Department in 1926 they increased the bridge loading from a 6 2/3 ton to a 10 ton axle load. Increased strength was obtained by reducing the spans to 15 feet, increasing the size of the timber deck beams to 12 inch by 7 inch and reducing their spacing to 2 feet. In 1928 the Department made a major change in the design of timber bridges by using round timber instead of sawn timber for the main beams. 18 inch diameter Jarrah logs were used at a spacing of 3 feet 3 inches and the span was increased back to 20 feet. The bridge load remained as a 10 ton axle load until 1945 when the American bridge loading of a 20 ton truck was adopted. The only changes required to accommodate the heavier modern loading was an increase in log size to 21 inch diameter and an increase in the size of sawn timber supports over the top of the piles from 12 inches by 6 inches to 14 inches by 7 inches. This design has remained virtually unchanged up to the present day.

Timber bridges have served Western Australia well from the earliest days of settlement right up to modern times and there are at present over 2 000 timber bridges in daily use on our roads. These bridges, originally designed to carry bullock carts and drays, are now carrying heavy high speed traffic, and it is only on the most heavily trafficked routes that it is proving necessary to stiffen up the older structures with a concrete overlay slab laid on the original timber deck. The success of these bridges has largely been due to the ready availability of two excellent local hardwoods, Jarrah (*E. marginata*) and Wandoo (*E. redunca*). Both these timbers are strong and durable and if cut from areas of poor soil where their growth rate has been slow they have a life of over 60 years.

The oldest timber bridge still in use on a public road today is the McCartney Street bridge over the Greenough River at Greenough. This 5 span bridge was built by convict labour in 1864 so that it is now 115 years old. The masonry piers are the original ones built from local stone and still in good condition. The original sawn timber beams are still in place but additional beams were added during the second World War to strengthen the structure. The bridge is currently restricted to loads of 5 tonnes but during this 150th Anniversary year it will be strengthened with new timber beams so that it can continue to serve the town of Greenough for many years to come.



McCartney Street Bridge over the Greenough River. Built by convicts in 1864 and still carrying traffic.

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